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ABSTRACT

The purpose of the document is to assess facilitating and interfering effects of various strategies in samples of children from elementary and high school grade levels. Participating in the paired-associate study were 160 children, 40 each from first, third, sixth, and eleventh grades. Subjects were required to learn a 36-item aurally presented paired-associate list under one of four conditions: (1) the traditional manner, empty control; (2) oral rote rehearsal of each pair, rote rehearsal; (3) with the aid of experimenter provided sentences, sentence provided; (4) with the aid of subject generated sentences, sentence generation. It was found that subjects who were given the facilitation instructions, sentence generated and sentence provided, performed significantly better at all grade levels than did subjects in the rote rehearsal and empty control. (Author)

A Developmental Study of Facilitation and Interference in Children's Paired-Associate Learning

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Abstract

One-hundred sixty children, forty each from first, third, sixth, and eleventh grades participated in a paired-associate study. Subjects were required to learn a 36-item aurally presented paired-associate list under one of four conditions: (1) the traditional manner, empty control, (2) oral rote rehearsal of each pair, rote rehearsal, (3) with the aid of experimenter provided sentences, sentence provided, (4) with the aid of subject generated sentences, sentence generation. It was found that subjects who were given the facilitation instructions, sentence generated and sentence provided, performed significantly better at all grade levels than did subjects in the rote rehearsal and empty control.

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[3] Personnel and students of the Milliken Elementary School and Bookser High School, Santa Clara, California have our appreciation for the extraordinary cooperation they extended in bringing this study to completion.

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Rohwer (1966) reported paired-associate learning data indicating that a S who hears a linking sentence such as "The COW chased the BALL," performs better than a control S who simply studies the pair without a sentence context. That is, linguistic elaboration facilitates S's recall of noun pairs. Bobrow and Bower (1969) report, "...that Ss better remembered noun pairs embedded in sentences they generated than they did pairs embedded in sentences E gave them (p. 455)." Thus, a qualification of the linguistic elaboration hypothesis suggests that S generated sentences facilitate noun pair recall better than E provided sentences.

With regard to the traditional control group in PA learning, Paivio, Yuille and Smythe (1966) assert that the performance of adults is simply not "controlled." Paivio et.al. report empirical evidence that the behavior of the S is less under the control of the experimental condition than the E has imagined. That is, Ssin the control condition spontaneously utilize mediators to learn noun pairs. One way of controlling spontaneous elaboration and reducing this source of variability is suggested by Bower (1969). The proposal is to supplant the traditional control group with one administered explicit rote

repetitive learning instructions (i.e. to learn by repeating the word pairs over and over to themselves). Bower finds that noun pair recall in the rote repetitive condition is significantly poorer than in linguistic and imaginal elaborative conditions.

In summary, for college-age subjects, traditional control instructions "control" nothing. However, a rote rehearsal strategy appears to "control" and depress noun pair recall. Linguistic elaborative strategies facilitate concrete noun pair recall with some studies reporting S generated sentences producing better recall than E provided sentences. To date there are no data reported contrasting these strategies with children.

The purpose of this study was to assess facilitating and interfering effects of various strategies in samples of children from elementary and high school grade levels. One of the secondary objectives was to design and execute a paired-associate task utilizing standard materials that were easily replicable over many samples.

Method

Subjects. Samples of 40 Ss each were drawn randomly from first, third, sixth and eleventh grade classes in a lower middle-class unified school district in the San Francisco-Bay area. The total sample numbered 160 children. Ten Ss from each subsample were randomly assigned to each of the four experimental conditions such that an independent group of Ss from each sample served under each condition.

Design. Four conditions were utilized in this study: empty control (EC), rote rehearsal (RR), sentence provided (SP), sentence generated (SG). The particular experimental strategies, auditory materials and procedures used in this study were selected to evaluate, (1) the facilitation of noun pair recall provided by linguistic elaboration (SP, SG) relative to the control conditions (EC, RR), (2) the facilitation of S generated sentences (SG) relative to E provided sentences (SP), (3) the traditional control group (EC) relative to an interfering strategy (RR). Thus, the experiment was intended to evaluate the notion that children across four grade levels perform differently when facilitating or interfering strategies are employed. The design is a three-way analysis of variance with the principal independent variables - experimental conditions (EC, RR, SP, SG), nested within grades (1,3,6,11) and trials (1,2).

Procedure. All Ss were asked to learn a list of 36 concrete noun pairs presented aurally on a Wollensak T-1500 audio tape-recorder. Both study and test cue words were recorded by a female. One female experimenter administered the paired-associate task to each S individually. The four experimental conditions were distinguished in terms of the procedure followed on instructions/examples and on the first pairing trial. All S's were given instructions and four examples appropriate to the condition for which they were selected. For example, a

S in the rote rehearsal (RR) condition would be administered general task instructions followed by "...When you hear a pair I want you to say the pair over and over until you hear the bell signaling you the next pair is coming up - then I want you to say that pair over and over again." Following these specific instructions, a study-test trial example consisting of four pairs was administered. These pairs were: pencil-paper, teeth-apple, clothespin-turtle, mop-saddle.

In the first condition, empty control (EC), Ss were administered standard PA instructions followed by four examples, then S listened to the audio tape containing 36 pairs of concrete nouns presented at a 15-sec. rate. A bell signaled the onset of each pair. In the second condition, rote rehearsal, (RR), Ss were requested to repeat the pair aloud, over and over until the bell rang signaling the onset of another pair to be repeated aloud. In the third condition, sentence provided, (SP), the S heard the pair followed by a simple declarative sentence containing the pair (e.g. GUITAR-SINK. The GUITAR laid on the SINK). The Ss were requested to "say" this sentence aloud over and over until the bell rang signaling the onset of the next pair. The bell signaling the onset of each pair was standard across all conditions and was heard on the first pairing trial only. The second pairing trial procedure was identical for all four conditions, that is, each S heard the list of 36 noun pairs presented at a 4-sec. rate. On both

test trials, one item from each pair was presented on the audio-tape, with Ss attempting to respond with the name of the other member of the pair. During the test trials, the items were presented at a 4-sec. rate in all conditions. A total of two pairing and two test trials were administered to all Ss.

Results

The dependent variable in this study was the number of correct responses given by Ss on the two test trials. The analysis of variance table is presented in Table 1.

Insert Table 1 about here

All hypotheses were tested with a probability of a Type 1 error equal to .05. It may be seen there are four significant sources of variation, namely, grades, conditions within grades, trials within grades, and conditions X trials within grades.

The effect of grades was significant F (3,144)=27.29. This effect was expected. The effect of experimental condition nested within grade, F (12,144)=10.64 is an interesting one. Within each grade level, planned pairwise comparisons revealed that the combined linguistic elaborative conditions (SG, SP) produced better recall of noun pairs than the combined control conditions (RR, EC). Thus, facilitation of noun pair recall was provided to first, third, sixth and eleventh grade Ss in the sentence generated and sentence provided conditions relative to Ss in the rote rehearsal and empty control

conditions. The means for the four conditions by trials within grade levels are presented in Table 2.

Insert Table 2 about here

In the comparison between the linguistic elaborative conditions, SG and SP, within each grade level, only in the sixth grade sample does the sentence generated condition significantly facilitate noun pair recall relative to the sentence provided condition, F (1,144)=5.15. Why this should occur in the sixth grade sample is indeterminate.

Pairwise comparisons were carried out for the empty control (EC) relative to the rote rehearsal (RR) condition. The sole significant comparison was within the eleventh grade F (1,144)=4.25. Thus, the rote rehearsal condition produced better recall of noun pairs than the empty control for the eleventh grade sample only. This result with a sample closely approximating college-age adults was unexpected. That is, prior empirical evidence indicated that the RR condition depresses performance relative to an EC condition.

Discussion

The results of the present investigation are consistent with the earlier finding of a facilitation in performance associated with linguistic elaboration in children (Rohwer, (1966). The results were replicated in a different mode of presentation (i.e. auditory).

The sentence generation and sentence provided comparisons suggest that first, third and eleventh grade Ss do not benefit significantly from self-generated utterances. This finding is contrary to results with college-age adults, where Bower (1969) reports a facilitation effect of self-generated sentences over experimenter provided sentences. However, the sixth grade sample's performance is facilitated by the self-generated utterances. It is unclear why this occurs in a group at mid-point in the age range discussed above.

In the comparisons between the traditional control and rote rehearsal condition, first, third, and sixth grade Ss seem to be "controlled". It appears they do not spontaneously engage in mediation that facilitates noun pair recall. This finding is contrary to data reported on college-age Ss (Bower, 1969; Paivio and Yuille, 1969). Although prior empirical evidence is less clear on the effects of rote rehearsal, the eleventh grade sample's performance was facilitated by the RR condition relative to EC. Paivio and Yuille (1969) report that the rote rehearsal interference effect disappears over trials. Bower (1969) finds the RR condition has a significant depressing effect on noun pair recall relative to elaborative conditions. One interpretation for these data is, Ss abandon strategies that are not facilitating noun pair recall. This does not appear to be a fruitful approach. A more intriguing query is, at what age do children spontaneously employ elab-

oration? The results of the present study suggest that in this lower middle-class sample, first, third, sixth and eleventh grade Ss do not spontaneously engage in elaborative strategies to recall noun pairs. However, linguistic elaborative strategies are employed when Ss are presented with them.

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Table 1

Analysis of Variance Table

Source	d/f	SS	MS	F	p
Between					
Grades	3		1573.67	27.29	* *
Cond/G					
G1	3	787.05	262.35	4.55	* *
G3	3	1977.14	659.05	11.43	* *
G6	3	2352.25	784.08	13.60	* *
G11	3	2248.24	749.41	13.00	* *
Subj/CG	144		57.65		

Source	d/f	SS	MS	F	p
Within					
Trials/G					
G1	1	405.00	405.00	62.06	* *
G3	1	515.11	515.11	78.93	* *
G6	1	793.80	793.80	121.63	* *
G11	1	1930.61	1930.61	295.82	* *
CxT/G					
G1	3	29.50	9.83	1.51	N.S.
G3	3	66.94	22.31	3.42	*
G6	3	49.10	16.37	2.51	N.S.
G11	3	39.14	13.05	2.00	N.S.
Within cell	144		6.53		

* $p < .05$

* * $p < .01$

Table 2

Mean Number of Correct Responses

as a Function of Conditions, Trials and Grades

Grades	Conditions											
	EC			RR			SP			SG		
	T1	T2	$\bar{X}$	T1	T2	$\bar{X}$	T1	T2	$\bar{X}$	T1	T2	$\bar{X}$
1	2.0	4.6	3.3	3.7	8.0	5.9	8.1	13.5	10.8	7.5	13.2	10.4
3	3.3	6.4	4.9	2.3	5.7	4.0	10.1	17.1	13.6	11.6	18.4	15.0
6	4.2	8.9	6.6	5.7	12.1	8.9	10.6	19.4	15.0	17.8	23.1	20.5
11	5.9	14.6	10.3	11.0	19.4	15.2	17.8	29.7	23.8	16.3	26.6	21.5